Los Alamos expertise integral to nuclear energy innovation hub

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LANL part of national team creating "virtual" reactor for next-generation power

LOS ALAMOS, New Mexico, June 3, 2010—Los Alamos National Laboratory materials scientists and computer modeling experts have been selected to participate in an effort by the U.S. Department of Energy to create a "virtual" reactor that could lead to the next generation of safer, longer-lasting, and less-expensive nuclear reactors.

U.S. Deputy Secretary of Energy Daniel Poneman recently announced the selection of a team led by Oak Ridge National Laboratory (ORNL) for an award of up to $122 million over five years to establish and operate a new Nuclear Energy Modeling and Simulation Energy Innovation Hub, also known as the Consortium for Advanced Simulation of Light Water Reactors (CASL). The Hub, which includes partners from universities, industry,

and other national labs, will use advanced capabilities of the world's most powerful computers to make significant leaps forward in nuclear reactor design and engineering.

Los Alamos National Laboratory will provide technical leadership and expertise in the arena of materials science and development of advanced numerical models, or computer codes, that will aid in realistic simulations of reactor core and structural materials. Los Alamos team members, in conjunction with members from the Massachusetts Institute of Technology, will realistically model the behavior of key materials such as reactor fuel or fuel cladding to provide better estimates of how those materials perform or fail within the extreme environment of a nuclear reactor.

The information gained through this effort will help extend the life and improve the efficiency of the existing U.S. nuclear reactor fleet and could help lead to the design of safer, longer-lasting materials in next-generation reactors.

"The CASL proposal is a unique blend of science, engineering, and industrial partnerships and I am pleased to have the world-class scientific capabilities of Los Alamos as a significant partner in this effort," said Terry Wallace, principal associate director for Science, Technology and Engineering at Los Alamos National Laboratory. "I look forward to the outstanding technical and engineering accomplishments that will flow from this hub."

Leveraging LANL's world-class materials science expertise, the Los Alamos and MIT researchers engaged in the Materials Performance and Optimization portion of the project will examine, at an atomistic scale, how reactor core materials are damaged under bombardment by radiation, through corrosion, or by chemical processes. These efforts will, in turn, enable development of a science-based predictive capability to be built within the virtual reactor tool.

"In order to improve the efficiency and safety of nuclear reactors, CASL aims to solve a number of challenging materials science issues that currently limit the performance of reactor components," said Chris Stanek of LANL's Materials Science and Technology Division. "I am very excited to lead the materials science effort for CASL and to begin work with our first class team on these stimulating and important problems."

The Nuclear Energy Innovation Hub is one of three Hubs that will receive funding in FY10. The Hubs are large, multidisciplinary, highly collaborative teams of scientists and engineers working over a longer time frame to achieve a specific high-priority goal, like developing fuels from sunlight in an economical way and making buildings more energy efficient. They will be managed by top teams of scientists and engineers with enough resources and authority to move quickly in response to new developments. Selections for the other Hubs will be announced over the coming months.

Specifically, the Nuclear Energy Innovation Hub will allow engineers to create a simulation of a currently operating reactor that will act as a "virtual model" of that reactor. They will then use the virtual model to address important questions about reactor operations and safety. This will be used to address such issues as reactor power production increases and reactor life and license extensions. The combination of data gained from the virtual model and the physical reactor will be used to resolve technology issues confronting nuclear energy development in the near, mid, and long terms.

"CASL is a unique scientific and engineering partnership focused on enhancing the use of the existing reactor fleet and the advancement of nuclear energy technologies and reactors through advanced modeling and simulation," said Stephen R. Lee, Los Alamos

CASL capture manager and leader of LANL’s Computer, Computational, and Statistical Sciences Division. "I look forward to exercising the full potential of this partnership and the successful execution of this outstanding proposal."

The Nuclear Energy Innovation Hub will be located at the ORNL site near Oak Ridge, Tennessee. In addition to ORNL, LANL, and MIT, the members of the team are: Electric Power Research Institute (EPRI), Palo Alto, California; Idaho National Laboratory, Idaho Falls, Idaho; North Carolina State University, Raleigh, North Carolina; Sandia National Laboratories, Albuquerque, New Mexico; Tennessee Valley Authority, Knoxville, Tennessee; University of Michigan, Ann Arbor, Michigan; Westinghouse Electric Company, Pittsburgh, Pennsylvania.

According to the recent DOE announcement, the Hub will be funded at up to $22 million this fiscal year. The Hub will then be funded at an estimated $25 million per year for the next four years, subject to Congressional appropriations. More information on the Hubs can be found at http://www.energy.gov/hubs/.